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A NEW NAME FOR A SPECIES OF POLYPODIUM FROM NORTHWESTERN NORTH AMERICA

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A biosystematic study of the *Polypodium vulgare* complex in the Pacific Northwest (Lang, 1965) has shown that there are three cytotypes present in the area from Alaska south along the Pacific Coast to central California and east to the Rocky Mountains that are apparently involved evolutionally with each other.

One, represented by *P. glycyrrhiza* D. C. Eaton, is uniformly diploid ($n = 37$) throughout its range and is morphologically, ecologically, and geographically distinct from another species in the area, *P. hesperium* Maxon.

Cytological investigations on *P. hesperium* have shown that this species is composed of two cytotypes, one diploid ($n = 37$) and one tetraploid ($n = 74$) (Evans, 1963; Knobloch, 1962; Lang, 1965; Lloyd, 1963, Manton, 1950).

The distinctive coastal species *P. scouleri* Hook and Grev. is also present in the study area but is not considered here as it does not appear to have played a role in the present problem.

The two cytotypes included in *P. hesperium* are quite distinct and separable on a number of points (Table I). It is felt that these differences are such as to warrant their recognition as distinct species.

TABLE I. CHARACTERS DISTINGUISHING THE TWO CYTOTYPES OF *P. HESPERIUM*

	<i>Tetraploid</i>	<i>Diploid</i>
Chromosome number	n = 74	n = 37
Frond shape	oblong	oblong
Segment shape	acute to obtuse	obtuse
Sorus shape	oval	circular
Sorus location	median	marginal (near margin than midrib)
Paraphyses	very rare	common
Rhizome pruinose	—	+
Rhizome taste	licorice	acid
Scale strip	absent	±
New fronds	summer	spring
Geographical distribution	interior (mostly east of Cascade Mountains)	Western mountains

Since the two cytotypes included in *P. hesperium* are recognized as two distinct species, it thus becomes necessary to establish to which cytotype the epithet *hesperium* properly belongs, the diploid or the tetraploid. *Polypodium hesperium* Maxon is the oldest available name which must be used for one or the other of the two cytotypes.

The type specimen of *P. hesperium* was compared morphologically with a range of both diploid and tetraploid specimens from throughout the Northwest, and chromosome determinations were made on topotype material. This comparison makes it clear that the tetraploid cytotype agrees very closely with the type specimen of *P. hesperium* Maxon. Among other features in common, both have oval sori located midway between the costa and segment margin, and a sweet licorice-like rhizome, as mentioned by Maxon (1900) in his original description. The diploid cytotype, on the other hand, has circular sori near the segment margin and an acid tasting rhizome. The geographical distributions give further evidence that the holotype of *P. hesperium* is tetraploid since, as far as is known, the diploid cytotype does not occur in the area of its type locality. A collecting trip to the type locality of *P. hesperium* in Coyote Canyon, Lake Chelan, Washington, yielded several isolated colonies of *Polypodium*. They were essentially similar in morphology and all plants on which chromosome counts were made proved to be tetraploid (**n** = 74). On the basis of the evidence there is little doubt that the tetraploid should bear the name *P. hesperium* Maxon.

The restriction of *P. hesperium* to the tetraploid cytotype apparently leaves the diploid cytotype without a name. There are, however, several

possible names in the literature which should be considered.

One epithet that might apply is *P. amorphum* Suksdorf, the type specimen of which was collected at the base of a shady cliff in Dog Creek Canyon, Skamania Co., Washington, in the region of the Columbia River Gorge. On the basis of a photograph in Frye (1934), examination of the type specimen and Suksdorf's description, this species has some features in common with the diploid cytotype, viz., a thin slender pruinose rhizome with typical scales and circular marginal sori with paraphyses. In morphology of the frond, *P. amorphum* is very variable with mostly semicircular frond segments and bifurcate frond tips. The diploid cytotype does not agree with it in these features.

In the fall of 1967 and again in the spring of 1968, I made two trips to Dog Creek to collect topotype material of *P. amorphum*. Dog Creek flows through a narrow precipitous canyon in a series of waterfalls, some up to 30 ft. high. The first trip involved a search of the lower reaches of the canyon from its mouth at the Columbia River to a point one-half mile upstream. Here further upstream search became impossible because of a high waterfall with no safe way around it. The only *Polypodium* found on this part of the stream was *P. glycyrrhiza*. Several additional attempts by others (Slater, 1964; pers. comm.) at the lower end of the canyon to re-collect *P. amorphum* have also failed.

The upper part of the canyon was reached on the second trip after a steep four and one-half mile hike up Dog Mountain and down a tributary stream to Dog Creek. Here it was discovered that Dog Creek and the tributary meet at the bottom of an inaccessible box canyon after a vertical fall of about 75 feet. Specimens of the diploid cytotype were seen growing, out of reach, from the underside of the overhanging cliffs. None of these plants appeared to be similar to *P. amorphum*. A search upstream from the head of the box canyon yielded only *P. glycyrrhiza*.

Since Suksdorf was about 70 years old when *P. amorphum* was first collected in 1925 and was under a doctor's order not to make extended collecting trips (Weber, 1944), it seems likely that he collected his type specimen from the lower end of the canyon. Weber (pers. comm.) concurs with this evaluation and states that Suksdorf definitely did not have an assistant to collect for him in the field. In making up specimens for distribution, Suksdorf returned to the type locality three times; in doing so he probably collected most of the existing plants, any survivors having subsequently died out. *Polypodium amorphum* seems to be an example of the "sports" that occasionally occur in various fern species with its unusual frond segments and bifurcate frond tips. In all probability *P. amorphum* is no longer an extant taxon due mainly to the zeal of its author.

Article 71 of the 1966 edition of International Code of Botanical Nomenclature states that a name must be rejected if it is based on a monstrosity. If one accepts that a monstrosity, in the botanical sense, is a plant that deviates greatly from the natural form or character, is ab-

normal, or is malformed, then *P. amorphum* must be rejected, since *P. amorphum* does deviate greatly from natural form (compare the photograph of the type of *P. amorphum* in Frye (1934) Fig. LVIII, with the drawing of the diploid cytotype of *P. hesperium*, Fig. LVII, 3 and 4, in Frye). If one accepts that it is merely a sport of the diploid cytotype of *P. hesperium* s.l., it is in any event abnormal in morphology when compared to most members of the *P. vulgare* complex.

One of the problems with Article 71, as pointed out by Davis and Heywood (1965), is that it fails to define a monstrosity. The definition given above is based on the 1966 edition of Webster's New Collegiate Dictionary. One of the examples of the application of Article 71 given in the rules refers to the orchid genus *Uropedium*, a peloric form with the third sepal (labellum) resembling the other two. The generic name, *Uropedium*, according to the rules, is based on a monstrosity and "must therefore be rejected." The monstrosity is now referred to as *Phragmipedium caudatum* (Lindl.) Rolfe.

If *P. amorphum* was a plant that represented a morphological extreme along a more or less continuous line of variation in the diploid cytotype of *P. hesperium* s.l., then it would be difficult to reject the name under Article 71. Article 7, note 1, states that the nomenclatural type is not necessarily the most representative element of a taxon; it is merely that element with which the name is permanently associated. An exception to this is when a name is based on a monstrosity (Benson 1962).

Since *P. amorphum* shows a very clear morphological discontinuity from the rest of the diploids in *P. hesperium* s.l., apparently no worse than the example of *Uropedium*, Article 71 makes the rejection of the epithet *amorphum* mandatory if the Code is to be followed. Of all the specimens examined in this study, none have approached the morphology of *P. amorphum*. In all probability the form arose only once and is now extinct.

Shivas (1961) has rejected the epithet *cambricum* for the European diploid *P. australe* Fee on the basis that *P. cambricum* L. is based on a monstrosity.

I accept a similar view that *P. amorphum* is based on a monstrosity and must be rejected under Article 71.

Several varietal names should be considered on the basis of Recommendation 60a of the Code. *P. vulgare* var. *columbianum* Gilbert cannot be used for the diploid cytotype since it is apparently a synonym of the tetraploid *P. hesperium*. All of the plants examined from the general area of the type locality, the Arrow Lakes in British Columbia, appear to be tetraploid; the diploid has not been found in the interior. Photographs of the type specimen indicate that it was probably tetraploid, also they agree closely with the type specimen of *P. hesperium* and with known tetraploid plants. In any case, the new combination *P. columbianum* for the diploid would be illegitimate since it would be a later homonym of *P. columbianum* Baker.

Clute (1910) described *Polypodium vulgare* var. *perpusillum* from Mount Lemon, Arizona and gave the following brief description: "Fronds one to four inches long, one-half to three-quarters of an inch wide diminishing below, pinnules oblong, obtuse, about eight pairs; sori medium size, numerous, near margin than midrib." This description more or less fits the diploid cytotype, especially the sori being near the margin than the midrib. Unfortunately, Clute's type specimen has not been located nor has topotype material been available for examination. The description is not precise enough to state with certainty that it is the same as the diploid cytotype of *P. hesperium* s.l.

In view of this the writer does not feel justified in taking up Clute's varietal epithet of *perpusillum* for the diploid cytotype, and so the new name *Polypodium montense* is proposed. Quantitative measurements are presented in following manner to display best their variability. Using stipe length as an example the shortest stipe measured was (8 mm long) (80% of all stipes measured were from 28 to 100 mm long, the average stipe length being 58 mm long) (the longest stipe was 142 mm long).

Polypodium montense F. A. Lang, nom. nov. *Polypodium amorphum* Suksdorf, Werdenia 1: 16, 1927. Holotype: Dog Creek Canyon, near Cooks, Skamania Co., Washington, *Suksdorf 11667*, WS.

Rhizoma repens, amarum, 3–5 mm per medium, saepe pruinose, paleaseum; squamae rhizomatum atrobrunneae vel castaneae, saepe axe centrali cellularum fuscatarum, anguste ovatae vel ovatae, saepe constrictae supra fundo, usque 5 mm longae, plerumque apicibus capillaribus, crasse dentatis, cellulis grandibus circa 25 numero trans squamam paulo supra fundo; frondes circa 130 mm longae, maxima longitudine circa 300 mm; stipites graciles, (8) (28–58–100) (142) mm longi; laminae coriaceae vel membranaceae, oblongae, (18) (46–81–122) (190) mm longae, (11) (17–24–30) (45) mm latae; laciniae oblongae vel obovatae, apicibus obtusis vel raro acutis, marginibus integris vel cernulatis, (5) (9–13–17) (25) mm longae, (3) (4–6–7) (12) mm latae, latitudine longitudini collata ut una pars duabus partibus confertur (1.2) (1.8–2.3–3.0) (3.6); venis liberis, semal atque iterum; hydathodi parvae, rotundae, paucis cellulis; sorus circularis, propior margini quam costae; paraphyses multae; chromosomatum numerus $n = 37$, $2n = 74$. Holotype: Cheakamus River, British Columbia, *Lang 211*, UBC.

Rhizome creeping, acrid, 3–5 mm in diameter, often pruinose, paleaceous; rhizome scales dark brown to castaneous, often with a central strip of darkly colored cells, narrowly ovate to obovate, often constricted above point of attachment, to 5 mm long, usually with a capillary tip, margin coarsely toothed, cells large, ca. 25 in number across scale just above point of attachment; frond averaging 130 mm long; max. ca. 300 mm long; stipe slender, (8) (28–58–100) (142) mm long; blades coriaceous to membranous, oblong (18) (46–81–122) (190) mm long, (11) (17–24–30) (45) mm wide; segments oblong to obovate, tips obtuse to

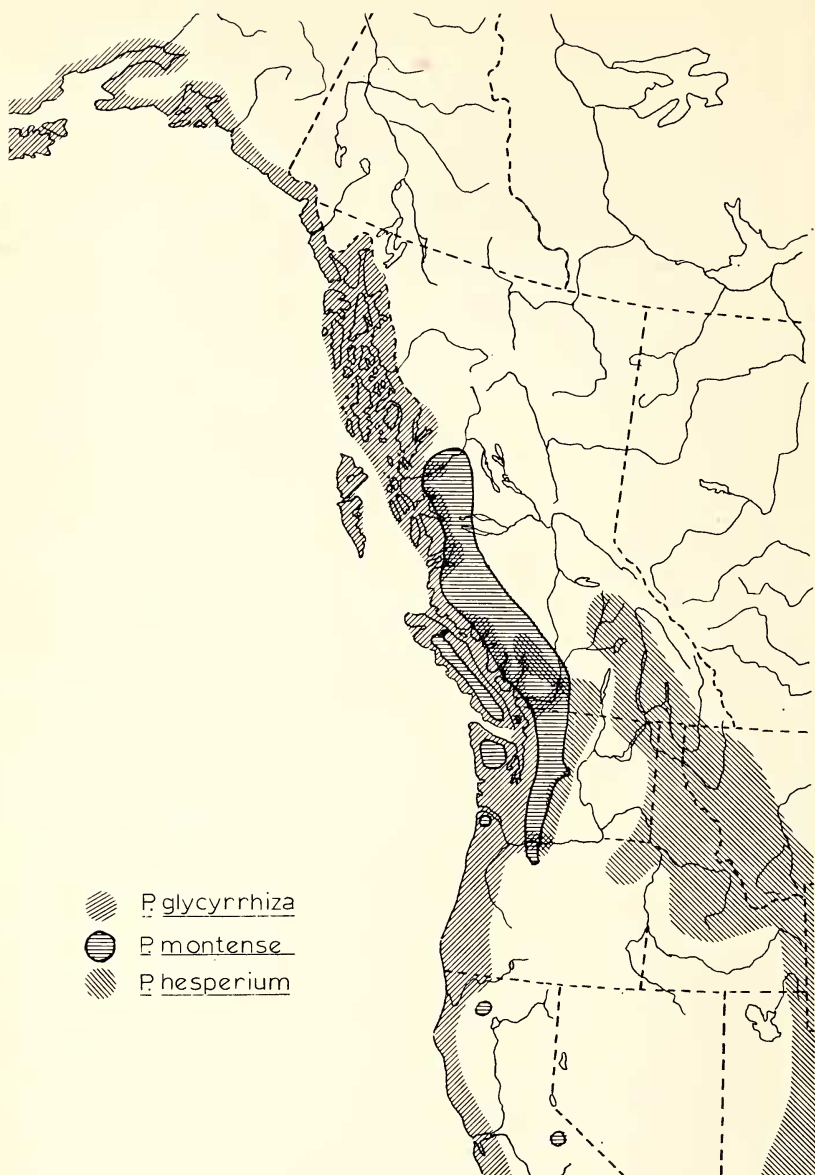


FIG. 1. Distribution of *Polypodium* in northwestern North America.

rarely acute, margin entire to crenulate, (5) (9–13–17) (25) mm long, (3) (4–6–7) (12) mm wide, ratio of length to width (1.2) (1.8–2.3–3.0) (3.6); hydathodes small, round, few-celled; veins free, forking 1–2 times; sorus circular, nearer the margin than the costa; paraphyses many; chromosome number $n = 37$, $2n = 74$.

New fronds produced from late April to June; found growing in rock crevices in mountains from central Coast Range in British Columbia south through the Cascade Mountains in Washington to Oregon and the Sierra Nevada Range in California, in the Olympic Mountains and Wenatchee Mountains of Washington and the Northern Coast Range of Oregon, usually at high elevations but descending to bottoms of river valleys.

The geographical distribution of *P. montense* is based on specimens from the following herbaria, UBC, UC, V, and WTU. Figure 1 shows the distribution of *P. montense*, *P. hesperium* and *P. glycyrrhiza* in Northwestern North America. *Polypodium montense* is apparently absent from the Mount Hood region of Oregon south to the Sierra Nevada Mountains in California.

A few herbarium specimens from the mountains of Northeastern Colorado, the Laramie Hills of southeast Wyoming and some of the high mountains of Arizona appear to be *P. montense*. The majority of specimens from the Rocky Mountain Region, however, are apparently the tetraploid *P. hesperium*.

Polypodium montense is closely related to *P. virginianum* L. of Eastern North America, sharing many features in common with it, but differing in its obtuse frond segments and geographical distribution. The possible role of *P. montense* in the parentage of the tetraploid cytotype of *P. virginianum* has already been discussed (Lloyd and Lang, 1964).

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THE PYGMY FOREST-PODSOL ECOSYSTEM AND ITS DUNE ASSOCIATES OF THE MENDOCINO COAST

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INTRODUCTION

Along the Mendocino coast some twenty irregular patches of pygmy forest, dominated by stunted cane-like cypresses (*Cupressus pygmaea*) and dwarfed bishop (*Pinus muricata*) and Bolander pines (*Pinus contorta* ssp. *bolanderi*), are surrounded by belts of tall bishop pines and shore pines (*Pinus contorta*) and by luxurious regional forests containing giant redwoods (*Sequoia sempervirens*) and Douglas firs (*Pseudotsuga menziesii*). This striking forest differentiation, marked by floristic endemism, has fascinated botanists ever since Bolander's early explorations over a century ago.

Bishop and Bolander pines, but not the shore pine, are closed-cone pines. Mason (1934) approached the problem of the origin of the coastal closed-cone pine forests from a broad point of view. Looking for natural barriers that would conserve pines, he ruled out—correctly we think—local climates, topographic constellations and especially country rock, as there are no serpentines, quartzites or other rock extremes. Mason then searched for a water barrier and assumed, in analogy with the fossil and living forests on Santa Cruz I. off Santa Barbara, that the coastal strips used to be Tertiary pine-populated islands that later united with the mainland and preserved their unique flora against infiltration from the continental forest. Just how the aggressive invaders from the regional redwood and Douglas fir forest were kept at bay during hundreds of thousands of years could not be explained. A good account of Mason's ideas is given by Cain (1944) and more recently by Langenheim and Durham (1963).

The possible role of soils in the floral discontinuities of the greater Fort Bragg area came into focus with the work of the Mendocino County Soil and Vegetation Survey during the late forties, and by the subsequent studies of Gardner and Bradshaw (1954) and Mason's student Mc-Millan (1956; 1964).